(19)日本国特許庁（ＪＰ）　(12) **公開特許公報（Ａ）**　(11)特許出願公開番号

特開平11－30164

(43)公開日　平成11年(1999)２月２日

(51)Int.Cl.[6]	識別記号	ＦＩ		
Ｆ０２Ｍ　43/04		Ｆ０２Ｍ　43/04		
Ｆ０２Ｄ　19/12		Ｆ０２Ｄ　19/12		Ａ
Ｆ０２Ｍ　23/00		Ｆ０２Ｍ　23/00		
25/022		25/02		Ｚ

審査請求　未請求　請求項の数１　ＦＤ　（全　５　頁）

(21)出願番号　特願平9－198003

(22)出願日　平成９年(1997)７月９日

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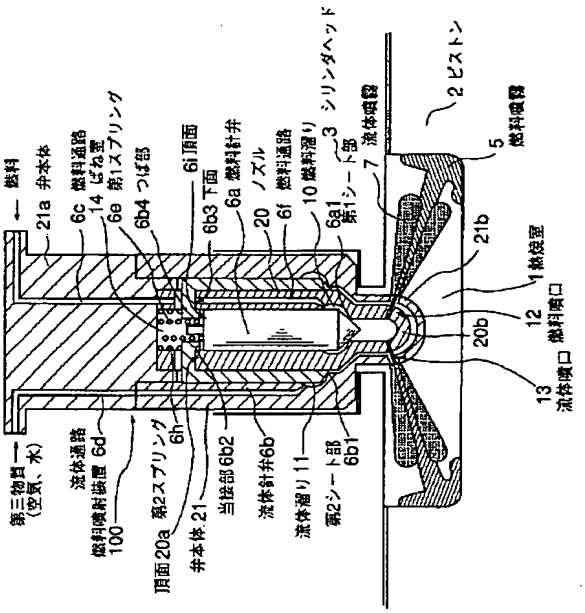
(54)【発明の名称】　内燃機関の燃料噴射装置

(57)【要約】

【課題】　直噴式内燃機関において、理論混合気比近傍での燃焼開始に伴う高温燃焼を抑制してＮＯｘの発生が低減された機関を提供する。

【解決手段】　燃料溜まり内の燃料を燃料噴口から燃焼室内に噴射させる燃料噴射弁を備えた内燃機関の燃料噴射装置において、空気、水等の流体が供給される流体溜まりと、前記燃料噴口の周囲に設けられた流体噴口と、前記流体溜まりと流体噴口との間を開閉可能に設けられ、前記燃料噴射弁の開弁過程で該燃料噴射弁に当接し前記第２スプリングの弾力により燃料噴射弁の燃料噴射始めよりも所定時間遅れて開弁して、前記流体溜まり内の流体を前記流体噴口から前記燃焼室内に噴射させる流体噴射弁とを備える。



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【特許請求の範囲】

【請求項１】　燃焼室内に燃料を噴射する燃料噴射口と、燃料溜り内に供給される燃料の圧力により、第１スプリングの弾力に抗して開弁し、前記燃料溜り内の燃料を前記燃料噴口から燃焼室内に噴射させる燃料噴射弁とを備えた内燃機関の燃料噴射装置において、

前記燃料噴口の周囲に設けられた流体噴口と、

該流体噴口と連通された流体溜りと、

該流体溜りに空気、水等の流体を供給する流体供給路と、

前記流体溜りと流体噴口との間を開閉可能に設置され、前記燃料噴射弁の開弁動作過程で該燃料噴射弁に当接し燃料噴射弁の開動作に従って開動作される流体噴射弁と、

該流体噴射弁を閉方向に付勢する第２スプリングとを具え、

前記流体噴射弁が前記第２スプリングの弾力に抗して前記燃料噴射弁の開動作始期より所定時間遅れて開弁し、前記流体溜り内の流体を前記流体噴口から前記燃焼室内に噴射可能に構成されていることを特徴とする内燃機関の燃料噴射装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明はピストンの上面に設けられた燃焼室内に直接燃料を噴射する直接噴射式内燃機関の燃料噴射装置に関する。

【０００２】

【従来の技術】図２～図３は燃料噴射弁より燃焼室内に直接燃料を噴射する形式の直接噴射式ディーゼル機関の燃焼室周りの構造を示し、図２はシリンダ中心線に沿う縦断面図、図３は燃焼室の平面図である。図２～図３において、２はピストン、３はシリンダヘッド、２５はシリンダ、１は該ピストン２の頂部中央に形成された燃焼室である。４は前記シリンダヘッド３に取付けられた多噴口の燃料噴射弁で、前記燃焼室１の略中央の上部に設けられ、該燃焼室１内に燃料を噴射する。

【０００３】かかる従来の直接噴射式ディーゼル機関の運転時において、ピストン２の圧縮行程終了近傍において該ピストン２により高圧高温に圧縮された燃焼室１内の空気中に燃料噴射弁４から燃料を噴射する。かかる噴射による燃料噴霧５は前記噴射弁４から放射状に噴出せしめられて微粒化され、燃焼室１内の空気と混合しながら発達し、自己着火燃焼せしめられる。

【０００４】

【発明が解決しようとする課題】図２～図３に示す従来技術に係る直接噴射式ディーゼル機関の運転時において、　燃焼噴射弁４から噴射された燃料噴霧５は噴射初期から燃焼室１内の周囲空気を導入しながら発達していき、通常、理論混合気比近傍で燃焼を開始する。このように理論混合気比近傍で燃焼を開始する領域の割合が高いと、燃焼ガスが高温となり窒素酸化物（ＮＯｘ）の多量発生の原因となっている。

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【０００５】然るに、前記のような、理論混合気比近傍で燃焼を開始する領域において生成されるＮＯｘの時空的な特性としては、燃料噴霧輝炎の存在する領域よりも火炎のやや外側の燃料濃度の薄い側の領域に存在し、その存在領域は、燃焼後期にその広がりが増加する。しかしながら前記従来技術に係る直接噴射式ディーゼル機関にあっては、一義的に設定された噴射時期、噴射期間で以って、公知の多噴口燃料噴射弁４により、燃料噴射がなされるので、前記理論混合気比近傍での燃焼を開始する領域の割合が高く、ＮＯｘの多量発生の抑制が困難であるという問題点を抱えている。

【０００６】本発明はかかる従来技術の課題に鑑み、前記理論混合気比近傍での燃焼開始に伴なう高温燃焼を抑制してＮＯｘの発生が低減された直接噴射式内燃機関を提供することを目的とする。

【０００７】

【課題を解決するための手段】本発明はかかる課題を解決するため、燃焼室内に燃料を噴射する燃料噴射口と、燃料溜り内に供給される燃料の圧力により、第１スプリングの弾力に抗して開弁し、前記燃料溜り内の燃料を前記燃料噴口から燃焼室内に噴射させる燃料噴射弁とを備えた内燃機関の燃料噴射装置において、前記燃料噴口の周囲に設けられた流体噴口と、該流体噴口と連通された流体溜りと、該流体溜りに空気、水等の流体を供給する流体供給路と、前記流体溜りと流体噴口との間を開閉可能に設置され、前記燃料噴射弁の開弁動作過程で該燃料噴射弁に当接し燃料噴射弁の開動作に従って開動作される流体噴射弁と、該流体噴射弁を閉方向に付勢する第２スプリングとを具え、前記流体噴射弁が前記第２スプリングの弾力に抗して前記燃料噴射弁の開動作始期より所定時間遅れて開弁し、前記流体溜り内の流体を前記流体噴口から前記燃焼室内に噴射可能に構成されていることを特徴とする。

【０００８】かかる発明によれば、燃料溜り内に燃料噴射ポンプから圧送された高圧燃料が供給されており、該燃料の圧力が燃料噴射弁を閉方向に押圧している第１スプリングの弾力に打ち勝つと燃料噴射弁が開弁し、燃料溜り内の燃料は燃料噴口より燃焼室内に噴射され、燃料噴霧を形成する。該燃料噴射始めから、所定時間後に燃料噴射弁と流体噴射弁とが当接されると、この時点で流体噴射弁が開弁し、流体溜り内に導入されている空気、水等の流体が流体噴射弁を経て流体噴口から燃焼室内に噴射される。

【０００９】かかる噴射動作において、前記流体噴口から噴射される流体は、燃料の噴射により燃焼室内に形成されている燃料噴霧輝炎が存在する領域の外側の、燃料濃度の薄い側の領域に、燃料噴射の期間中で燃料噴射始めよりも遅れて噴射されて、流体噴霧を形成することと

なる。これによってＮＯｘの多量発生の時空的な位置である前記領域におけるガス温度が、前記流体噴霧の形成によって低下せしめられ、ＮＯｘの生成反応が抑圧され、低ＮＯｘ高効率の燃焼が得られる。

【００１０】

【発明の実施の形態】以下、図面を参照して本発明の好適な実施形態を例示的に詳しく説明する。但しこの実施形態に記載されている構成部品の寸法、材質、形状、その相対的配置等は特に特定的な記載がないかぎりは、この発明の範囲をそれに限定する趣旨ではなく、単なる説明例にすぎない。

【００１１】図１は本発明の実施形態に係る直接噴射式ディーゼル機関の燃料噴射弁及びその近傍を示す要部断面図である。図１において、２はピストン、３はシリンダヘッド、１は該ピストン２の頂部中央に形成された燃焼室である。１００は前記シリンダヘッド３の中央下部に、前記燃焼室１に対向するように取付けられた燃料噴射装置である。

【００１２】本発明の実施形態は図２～図３に示される従来の燃料噴射弁４に代えて、図１に示す燃料噴射装置１００を装備したことを特徴としている。以下その詳細について説明する。

【００１３】図１に示す燃料噴射装置１００において、２１ａ，２１は上・下の弁本体であり、ボルト（図示省略）により締め付けられ一体化されている。２０は中空に形成された前記弁本体２１の内部にこれと同心に収納されたノズルであり、該ノズル２０内にはこれと同心に燃料針弁６ａが摺動自在に嵌合されている。６ａ１は該燃料針弁６ａとノズル２０とのシート面即ち第１シート部である。該第１シート部６ａ１は前記燃料針弁６ａの頂面６ｉと弁本体２１ａとの間に介装された第１スプリング６ｅの弾力により押し付けられている。

【００１４】６ｂは流体針弁で、前記ノズル２０の外周と弁本体２１の内周との間に、これらと同心で以って摺動自在に嵌挿されている。前記流体針弁６ｂの下端は前記弁本体２１との間にシート面即ち第２シート部６ｂ１を形成している。該第２シート部６ｂ１は前気流体針弁６ｂの頂部であるつば部６ｂ４と前記弁本体２１ａとの間に介装された第２スプリング６ｈの弾力により押し付けられている。また、前記流体針弁６ｂのつば部６ｂ４の下面６ｂ３と前記ノズル２０の頂面２０ａとの間は、前記第２シート部６ｂ１が当接したとき燃料が通過し得る程度の微小量の隙間が形成されるようになっている。

【００１５】１０は前記ノズル２０の内部に、前記第１シート部６ａ１が臨むように形成された燃料溜りであり、該燃料溜り１０には、弁本体２１ａ内の燃料通路６ｃ、ばね室１４、前記つば部６ｂ４下側の隙間、及びノズル２０内の燃料通路６ｆを経て燃料噴射ポンプ（図示省略）からの燃料が供給されている。１１は前記弁本体２１の内部に、前記第２シート部６ｂ１が臨むように形成された流体溜りであり、該流体溜り１１には、弁本体２１ａ及び２１内の流体通路６ｄを経て空気、水等の第３物質が供給されている。また、前記燃料針弁６ａと流体針弁６ｂとは、該燃料針弁６ａがリフトし、その頂面６ｉが流体針弁６ｂのつば部６ｂ４の下面である当接部６ｂ２と当接した後は、該燃料針弁６ａと流体針弁６ｂとが一体的にリフトするように関係づけられている。

【００１６】前記ノズル２０の下部及び弁本体２１の下部には同心の中空の半球状部２０ｂ、２１ｂが形成されている。そして、ノズル２０側の半球状部２０ｂには燃料噴射用の複数の燃料噴口１２が放射状に穿設され、また弁本体２１側の半球状部２１ｂには空気、水等の第３物質噴射用の流体噴口１３が穿設されている。該流体噴口１３は前記燃料噴口１２の延長線上に設けられ、該燃料噴口１２と同数かつ燃料噴口１２よりも大径に形成されている。

【００１７】かかる構成からなる燃料噴射装置を備えた直接噴射式ディーゼル機関の運転時において、燃料噴射ポンプ（図示省略）から適当なタイミングで以って圧送された燃料は、弁本体の燃料通路６ｃ、ばね室１４、ノズル２０の頂面２０ａとつば部６ｂ４の下面６ｂ３との間の隙間及びノズル２０内の燃料通路６ｆを通って燃料溜り１０に至り、燃料針弁６ａのシート部６ａ１に作用する。かかる燃料の圧力が第１スプリング６ｅの弾力に打ち勝つと燃料針弁６ａのシート部６ａ１が離れて該針弁６ａが開弁する。これにより、燃料溜り１０内の燃料は燃料噴口１２から燃焼室１内の壁面に向かって高圧で噴射され、燃焼室１内に燃料噴霧５を形成し、着火、燃焼せしめられる。

【００１８】前記燃料針弁６ａがリフトして、その頂面６ｉが流体灰弁６ｂの当接部６ｂ２に当接した後は、燃料針弁６ａがリフトすると、これとともに流体針弁６ｂもリフトすることとなる。つまり、燃料針弁６ａと流体針弁６ｂとの当接後には、両針弁６ａ・６ｂは、第１・第２スプリング６ｅ、６ｈの弾力に抗してリフトせしめられ、第２シート部６ｂ１が離れて流体針弁６ｂが開弁し、流体通路６ｄから流体溜り１１内に導入されている空気、水等の第３物質が流体噴口１３から燃焼室１内に噴射される。

【００１９】この際において、最初に燃料針弁６ａが開弁して燃焼室１内に燃料が噴射され、燃料針弁６ａの頂面６ｉと流体針弁６ｂの当接面６ｂ２とが当接するまでは燃料噴口１２から燃料のみが噴射され、前記当接とともに流体針弁６ｂが開弁することにより、燃料噴口１２から燃料が噴射されるとともに、流体噴口１３から空気、水等の第３物質が噴射される。この第３物質は、前記流体噴口１３の径が燃料噴口１２の径より大きいため、図１のように流体噴霧７は燃料噴霧５の外側に幅広に形成されることとなる。

【００２０】即ち前記流体噴口１３から噴射される第３

物質は、燃焼室１内に形成される燃料噴霧輝炎５が存在する領域の外側の燃料濃度の薄い側の領域に、燃料噴口１２からの燃料噴射の期間中で、燃料噴射の後期に噴射されて流体噴霧７を形成することとなる。これによって、前記ＮＯｘの多量発生の時空的な位置である前記領域におけるガス温度が、かかる第３物質の噴射による流体噴霧７の形成により低下せしめられ、ＮＯｘの生成反応が抑制され、低ＮＯｘ、高効率の燃焼が得られる。

【００２１】

【発明の効果】以上記載のごとく、本発明によれば、燃料の噴射により燃焼室内に形成されている燃料噴霧輝炎が存在する領域の外側の燃料濃度の薄い側の領域に、流体噴口から空気、水等の流体が、燃料噴射の期間中で燃料噴射始めよりも遅れて噴射されて、流体噴霧を形成することとなる。これにより、ＮＯｘの多量発生の時空的な位置である前記領域におけるガス温度が前記流体噴霧の形成によって低下せしめられ、ＮＯｘの生成反応が抑制され、低ＮＯｘ、高効率の燃焼が可能な直接噴射式内燃機関を得ることができる。

【図面の簡単な説明】

【図１】本発明の実施形態に係る直接噴射式ディーゼル機関の燃料噴射装置の縦断面図である。

【図２】従来技術に係る直接式ディーゼル機関の燃焼室周りの縦断面図である。

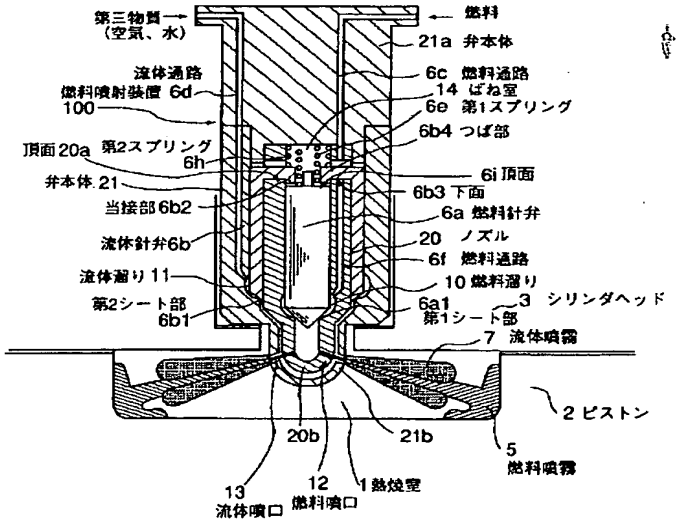
【図３】図２に対応する平面配置図である。

【符号の説明】

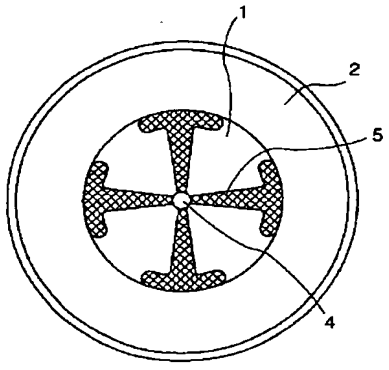
１	燃焼室	＊３	シリンダヘッド
２	ピストン	５	燃料噴霧
		６ａ	燃料針弁
		６ａ１	第１シート部
		６ｂ	流体針弁
		６ｂ１	第２シート部
		６ｂ２	当接部
		６ｂ３	下面
		６ｂ４	つば部
		６ｃ	燃料通路
		６ｄ	流体通路
		６ｅ	第１スプリング
		６ｆ	燃料通路
		６ｈ	第２スプリング
		６ｉ	頂面
		７	流体噴霧
		１０	燃料溜り
		１１	流体溜り
		１２	燃料噴口
		１３	流体噴口
		２０	ノズル
		２０ａ	頂面（ノズル）
		２０ｂ	半球状部（ノズル）
		２１	弁本体
		２１ａ	弁本体
		２１ｂ	半球状部（弁本体）
		１００	燃料噴射装置

＊

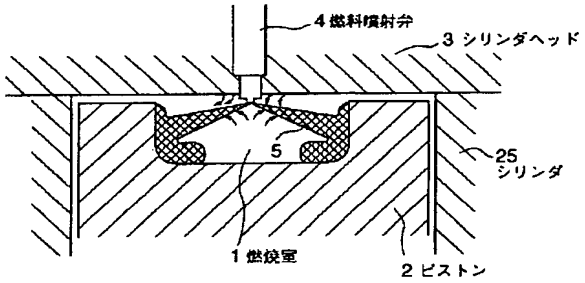
【図１】



【図３】



【図２】



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CLAIMS

[Claim(s)]
[Claim 1] With the pressure of the fuel injection tip which injects a fuel to a combustion chamber, and the fuel supplied in ******** In the fuel injection equipment of the internal combustion engine having the fuel injection valve which the elasticity of the 1st spring is resisted [fuel injection valve], and it opens [fuel injection valve] and makes a combustion chamber inject the fuel in said ******** from said fuel nozzle hole The fluid nozzle hole prepared in the perimeter of said fuel nozzle hole, this fluid nozzle hole, and fluid **** opened for free passage, It is installed possible [closing motion of between the fluid supply way which supplies fluids, such as air and water, to this fluid ****, and said fluid **** and fluid nozzle hole]. The fluid injection valve by which open actuation is carried out according to open actuation of a fuel injection valve in contact with this fuel injection valve in the valve-opening actuation process of said fuel injection valve, Have the 2nd spring which energizes this fluid injection valve in the closed direction, and said fluid injection valve resists the elasticity of said 2nd spring, and opens later than [predetermined time] the ******** term of said fuel injection valve. The fuel injection equipment of the internal combustion engine characterized by said combustion chamber constituting the fluid in said fluid **** from said fluid nozzle hole possible [injection].

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the fuel injection equipment of the direct injection internal combustion engine which injects a direct fuel to the combustion chamber prepared in the top face of a piston.
[0002]
[Description of the Prior Art] Drawing of longitudinal section where drawing 2 - drawing 3 show the structure of the circumference of the combustion chamber of the direct injection Diesel engine of the format which injects a direct fuel from a fuel injection valve to a combustion chamber, and drawing 2 meets a cylinder center line, and drawing 3 are the top views of a combustion chamber. As for 2, in drawing 2 - drawing 3 , a piston and 3 are the combustion chambers where the cylinder head and 25 were formed in the cylinder and 1 was formed in the center of a crowning of this piston 2. 4 is the fuel injection valve of the many nozzle holes attached in said cylinder head 3, is prepared in the upper part of the center of abbreviation of said combustion chamber 1, and injects a fuel in this combustion chamber 1.
[0003] In the time of operation of this conventional direct injection Diesel engine, a fuel is injected from a fuel injection valve 4 in the air in the combustion chamber 1 compressed into the high-pressure elevated temperature by this piston 2 [near the compression stroke termination of a piston 2]. The fuel spray 5 by this injection can blow off from said injection valve 4 to a radial, and is closed and atomized, mixing with the air in a combustion chamber 1, it progresses and self-ignition combustion of it is carried out.
[0004]
[Problem(s) to be Solved by the Invention] In the time of operation of the direct injection Diesel engine concerning the conventional technique shown in drawing 2 - drawing 3 The fuel spray 5 injected from the combustion injection valve 4 progresses introducing the perimeter air in a combustion chamber 1 from the early stages of injection, and usually starts combustion near the stoichiometric-mixture ratio. Thus, if the rate of the field which starts combustion near the stoichiometric-mixture ratio is high, combustion gas serves as an elevated temperature and causes abundant generating of nitrogen oxides (NOx).
[0005] it is alike, and as a space-time-property of NOx generated in the appropriate field which starts combustion near [above] the stoichiometric-mixture ratio, it exists in the field of a side with outside a little thin fuel concentration of a flame, and, as for the existence region, the breadth increases from the field where a fuel-spray luminous flame exists to a combustion anaphase. however, fuel injection timing and the fuel injection period which were uniquely set up if the direct injection Diesel engine concerning said conventional technique had -- with -- **** -- by the well-known multi-nozzle-hole fuel injection valve 4, since fuel injection is made, the rate of the field which starts combustion near [said] the stoichiometric-mixture ratio is high, and the trouble that control of abundant generating of NOx is difficult is held.
[0006] This invention aims at offering the direct injection internal combustion engine which controls the elevated-temperature combustion accompanying combustion initiation near [said] the stoichiometric-mixture ratio and by which generating of NOx was reduced in view of the

technical problem of this conventional technique.
[0007]
[Means for Solving the Problem] In order that this invention may solve this technical problem, with the pressure of the fuel injection tip which injects a fuel to a combustion chamber, and the fuel supplied in ******** In the fuel injection equipment of the internal combustion engine having the fuel injection valve which the elasticity of the 1st spring is resisted [fuel injection valve], and it opens [fuel injection valve] and makes a combustion chamber inject the fuel in said ******** from said fuel nozzle hole The fluid nozzle hole prepared in the perimeter of said fuel nozzle hole, this fluid nozzle hole, and fluid **** opened for free passage, It is installed possible [closing motion of between the fluid supply way which supplies fluids, such as air and water, to this fluid ****, and said fluid **** and fluid nozzle hole]. The fluid injection valve by which open actuation is carried out according to open actuation of a fuel injection valve in contact with this fuel injection valve in the valve-opening actuation process of said fuel injection valve, Have the 2nd spring which energizes this fluid injection valve in the closed direction, and said fluid injection valve resists the elasticity of said 2nd spring, and opens later than [predetermined time] the ******** term of said fuel injection valve. It is characterized by said combustion chamber constituting the fluid in said fluid **** from said fluid nozzle hole possible [injection].
[0008] According to this invention, the high-pressure fuel fed from the fuel injection pump is supplied in ********, if the elasticity of the 1st spring with which the pressure of this fuel is pressing the fuel injection valve in the closed direction is overcome, a fuel injection valve will open, and from a fuel nozzle hole, the fuel in ******** is injected by the combustion chamber and forms the fuel spray. If a fuel injection valve and a fluid injection valve are contacted after predetermined time from this fuel fuel injection beginning, a fluid injection valve will open at this time, and fluids introduced in fluid ****, such as air and water, will be injected by the combustion chamber from a fluid nozzle hole through a fluid injection valve.
[0009] In this injection actuation, in the period of fuel injection, the fluid injected from said fluid nozzle hole will be late for fuel fuel injection beginning, will be injected by the field of a side with the thin fuel concentration of the outside of the field where the fuel-spray luminous flame currently formed in the combustion chamber of injection of a fuel exists rather than it, and will form fluid spraying in it. The gas temperature in said field which is the space-time-location of abundant generating of NOx is made to fall by formation of said fluid spraying, the generation reaction of NOx is oppressed by this, and combustion of a low NOx well head is obtained.
[0010]
[Embodiment of the Invention] Hereafter, with reference to a drawing, the suitable operation gestalt of this invention is explained in detail in instantiation. However, the dimension of the component part indicated by this operation gestalt, the quality of the material, a configuration, its relative arrangement, etc. are not the meaning that limits the range of this invention to it but only the mere examples of explanation, as long as there is no specific publication especially.
[0011] Drawing 1 is the important section sectional view showing the fuel injection valve of the direct injection Diesel engine concerning the operation gestalt of this invention, and its near. In drawing 1 , 2 is the combustion chamber where a piston and 3 were formed in the cylinder head and 1 was formed in the center of a crowning of this piston 2. 100 is the fuel injection equipment attached so that the central lower part of said cylinder head 3 might be countered in said combustion chamber 1.
[0012] It is characterized by having replaced the operation gestalt of this invention with the conventional fuel injection valve 4 shown in drawing 2 - drawing 3 , and equipping the fuel injection equipment 100 shown in drawing 1 . The detail is explained below.
[0013] In the fuel injection equipment 100 shown in drawing 1 , 21a and 21 are the valve bodies of a top and the bottom, are bound tight with a bolt (illustration abbreviation) and are unified. Inside said valve body 21 formed in midair, 20 is the nozzle contained by this and this alignment, and fitting of the sliding of fuel needle-valve 6a of it is made free to this and this alignment into this nozzle 20. Six a1 is, the sheet surface, i.e., 1st sheet section, of this fuel needle-valve 6a and a nozzle 20. This 1st sheet section six a1 is forced by the elasticity of 1st spring 6e infixed between top-face 6i of said fuel needle-valve 6a, and valve body 21a.

[0014] 6b -- a fluid needle valve -- it is -- between the periphery of said nozzle 20, and the inner circumference of the valve body 21 -- these and this alignment -- with -- **** -- it is fitted in free [sliding]. The lower limit of said fluid needle-valve 6b forms the sheet surface six b1, i.e., the 2nd sheet section, between said valve bodies 21. This 2nd sheet section six b1 is forced by the 2nd spring 6h elasticity infixed between the flange section six b4 which is a crowning of last air-current object needle-valve 6b, and said valve body 21a. Moreover, between the inferior surface of tongue six b3 of the flange section six b4 of said fluid needle-valve 6b, and top-face 20a of said nozzle 20, when said 2nd sheet section six b1 contacts, the clearance between the minute amounts which are extent which a fuel may pass is formed.
[0015] 10 is ******** formed so that said 1st sheet section six a1 might attend the interior of said nozzle 20, and the fuel from a fuel injection pump (illustration abbreviation) is supplied to this ******** 10 through fuel path 6c in valve body 21a, the spring room 14, the clearance between said six bflange section 4 bottoms, and 6f of fuel paths in a nozzle 20. 11 is fluid **** formed so that said 2nd sheet section six b1 might attend the interior of said valve body 21, and the 3rd matter, such as air and water, is supplied to this fluid **** 11 through 6d of fluid channels in valve body 21a and 21. Moreover, after this fuel needle-valve 6a carries out a lift and the top-face 6i contacts the contact section six b2 which is the inferior surface of tongue of the flange section six b4 of fluid needle-valve 6b, said fuel needle-valve 6a and fluid needle-valve 6b are connected so that this fuel needle-valve 6a and fluid needle-valve 6b may carry out a lift in one.
[0016] The hemispherical sections 20b and 21b of the hollow of this alignment are formed in the lower part of said nozzle 20, and the lower part of the valve body 21. And two or more fuel nozzle holes 12 for fuel injection are drilled in hemispherical section 20b by the side of a nozzle 20 by the radial, and the fluid nozzle hole 13 for the 3rd matter injection of air, water, etc. is drilled in hemispherical section 21b by the side of the valve body 21. This fluid nozzle hole 13 is formed on the production of said fuel nozzle hole 12, and is formed in the major diameter rather than this fuel nozzle hole 12, the same number, and the fuel nozzle hole 12.
[0017] the time of operation of the direct injection Diesel engine having the fuel injection equipment which consists of this configuration -- setting -- timing suitable from a fuel injection pump (illustration abbreviation) -- with -- **** -- the fed fuel It results in ******** 10 through the clearance between fuel path 6c of a valve body, the spring room 14, and top-face 20a of a nozzle 20 and the inferior surface of tongue six b3 of the flange section six b4, and 6f of fuel paths in a nozzle 20, and acts on the sheet section six a1 of fuel needle-valve 6a. If the pressure of this fuel overcomes the elasticity of 1st spring 6e, the sheet section six a1 of fuel needle-valve 6a will separate, and this needle-valve 6a will open. Thereby, the fuel in ******** 10 is injected with high pressure toward the wall surface in a combustion chamber 1 from the fuel nozzle hole 12, forms the fuel spray 5 in a combustion chamber 1, and is made to light and burn.
[0018] After said fuel needle-valve 6a carries out a lift and the top-face 6i contacts the contact section six b2 of fluid **** 6b, when fuel needle-valve 6a carries out a lift, the lift also of the fluid needle-valve 6b will be carried out with this. that is, after the contact to fuel needle-valve 6a and fluid needle-valve 6b The lift of both needle-valves 6a and the 6b is resisted and carried out to spring [1st-2nd /e / 6 / and 6h] elasticity, the 2nd sheet section six b1 separates, fluid needle-valve 6b opens, and the 3rd matter introduced in fluid **** 11 from 6d of fluid channels, such as air and water, is injected in a combustion chamber 1 from the fluid nozzle hole 13.
[0019] In this case, set, fuel needle-valve 6a opens first, and a fuel is injected in a combustion chamber 1. While only a fuel is injected from the fuel nozzle hole 12, and a fuel is injected from the fuel nozzle hole 12 when fluid needle-valve 6b opens with said contact until top-face 6i of fuel needle-valve 6a and the contact side six b2 of fluid needle-valve 6b contact The 3rd matter, such as air and water, is injected from the fluid nozzle hole 13. Since this 3rd matter has the path of said fluid nozzle hole 13 larger than the path of the fuel nozzle hole 12, the fluid spraying 7 will be broadly formed in the outside of the fuel spray 5 like drawing 1 .
[0020] That is, in the period of the fuel injection from the fuel nozzle hole 12, the 3rd matter injected from said fluid nozzle hole 13 will be injected by the field of a side with the thin fuel concentration of the outside of the field where the fuel-spray luminous flame 5 formed in a

combustion chamber 1 exists at the anaphase of fuel injection, and will form the fluid spraying 7 in it. The gas temperature in said field which is the space-time-location of abundant generating of said NOx is made to fall by formation of the fluid spraying 7 by injection of this 3rd matter, the generation reaction of NOx is controlled by this, and low NOx and efficient combustion are obtained.

[0021]

[Effect of the Invention] Above, like a publication, according to this invention, fluids, such as air and water, will be late for fuel fuel injection beginning in the period of fuel injection from a fluid nozzle hole, it will be injected by the field of a side with the thin fuel concentration of the outside of the field where the fuel-spray luminous flame currently formed in the combustion chamber of injection of a fuel exists, and fluid spraying will be formed in it. The gas temperature in said field which is the space-time-location of abundant generating of NOx is made to fall by formation of said fluid spraying by this, the generation reaction of NOx is controlled, and the direct injection internal combustion engine in which low NOx and efficient combustion are possible can be obtained.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is drawing of longitudinal section of the fuel injection equipment of the direct injection Diesel engine concerning the operation gestalt of this invention.
[Drawing 2] It is drawing of longitudinal section of the circumference of the combustion chamber of the direct type Diesel engine concerning the conventional technique.
[Drawing 3] It is a plane configuration Fig. corresponding to drawing 2 .
[Description of Notations]
1 Combustion Chamber
2 Piston
3 Cylinder Head
5 Fuel Spray
6a Fuel needle valve
Six a1 The 1st sheet section
6b Fluid needle valve
Six b1 The 2nd sheet section
Six b2 Contact section
Six b3 Inferior surface of tongue
Six b4 Flange section
6c Fuel path
6d Fluid channel
6e The 1st spring
6f Fuel path
6h The 2nd spring
6i Top face
7 Fluid Spraying
10 ********
11 Fluid ****
12 Fuel Nozzle Hole
13 Fluid Nozzle Hole
20 Nozzle
20a Top face (nozzle)
20b Hemispherical section (nozzle)
21 Valve Body
21a Valve body
21b Hemispherical section (valve body)
100 Fuel Injection Equipment

[Translation done.]